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Popular Article

Pesticides of Last Decade: Impact on Health and Environment and their Remedies

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Introduction

A pesticide is a toxic chemical substance or a mixture of substances or biological agents that are intentionally released into the environment in order to control and/or kill and destroy populations of insects, weeds, rodents, fungi or other harmful pests. Pests can be broadly defined as “the plants or animals that jeopardize our food, health and / or comfort”.

The use of pesticides has increased many folds over the past few decades. The use of pesticides for pest mitigation has become a common practice all around the world. The risks associated with their use have surpassed their beneficial effects. Nonselective pesticides kill non-target plants and animals along with the targeted ones.

Pesticide Use: From Past to Present

The use of pesticides dates back to the times of Ancient Romans where people used to burn sulphur for killing pests and used salts, ashes and bitters for controlling weeds. A Roman naturalist urged the use of arsenic as an insecticide. In 1600s, a mixture of honey and arsenic was used for controlling ants. In late 1800s, farmers in the USA started using certain chemicals such as nicotine sulphate, calcium arsenate and sulphur for field related pests. The major breakthrough in pesticide development occurred in the period around and after World War-II, when several effective and inexpensive pesticides were synthesised and produced. This period is marked by the discovery of Aldrin, dichlorodiphenyltrichloroethane (DDT) in 1939, Dieldrin, β -Benzene Hexachloride (BHC), 2,4-Dichlorophenoxyacetic acid (2,4-D), Chlordane and Endrin. Fungicides, captan and glyodin and organophosphate insecticide Malathion were

introduced between 1950 and 1955 followed by the discovery of triazine herbicides in the years 1955–1960.

In 1962, an American scientist Rachel Carson highlighted in her book, *Silent Spring*, that spraying DDT in the field causes sudden death of non-target organisms either by direct or indirect toxicity. *Silent Spring* resulted in silence in the field of research on pesticide discovery and development. In 1970–1980s, pyrethroids, sulfonylureas, synthetic fungicides triadimefron and metaxyl were introduced. In 1972, DDT was completely banned in the USA. In 2001, 179 nations signed an international treaty known as Stockholm Convention that was intended to completely ban twelve Persistent Organic Pollutants (POP's) including DDT. Later in 2013, the European Union (EU) supported to banning the use of neonicotinoid pesticides

Classification of Pesticides

Worldwide pesticides are divided into different categories depending upon their target. Some of these categories include;

- Herbicides- These are the chemicals used to kill weeds e.g. borax, nitrofen
- Insecticide- These are used to kill insect e.g. DDT, BHC
- Rodenticide- These are used to kill rodents e.g. warfarin, zinc phosphide
- Nematicide- Used to kill nematodes e.g. DBCP, phorate
- Molluscicide- Used to kill mollusks e.g. metaldehyde

Risks associated with pesticide use

Risks associated with pesticide use have surpassed their beneficial effects. Pesticides have drastic effects on non-target species and affect animal and plant biodiversity, aquatic as well as terrestrial food webs and ecosystems. Uncontrolled use of pesticides has resulted in reduction of several terrestrial and aquatic animal and plant species.

Threats to Aquatic Biodiversity

Pesticide-contaminated water poses a great threat to aquatic form of life. It can affect aquatic plants, decrease dissolved oxygen in the water and can cause physiological and behavioural changes in fish populations. With the overuse of pesticides, a decline in populations of different fish species is observed and leads to reduced fish productivity.

Threats to Terrestrial Biodiversity

Pesticide exposure can also cause sub-lethal effects on terrestrial plants in addition to killing non-target plants. Populations of beneficial insects such as bees and beetles can significantly decline by the use of broad-spectrum insecticides such as carbamates, organophosphates and pyrethroids. Neonicotinoids insecticides such as clothianidin and



imidacloprid are toxic to bees. One of the major causes in the massive decline in the birds population is the use of pesticides. Bald eagle populations in the USA declined primarily because of exposure to DDT and its metabolites. Organophosphate insecticides are highly toxic to birds and they are known to have poisoned raptors in the fields.

Pesticide Impact on Human Health

Pesticides have improved the standard of human health by controlling vector-borne diseases, however, their long term and indiscriminate use has resulted in serious health effects. Human beings especially infants and children are highly vulnerable to deleterious effects of pesticides. As the pesticide use has increased over the past few decades. According to World Health Organization, each year, about 3,000,000 cases of pesticide poisoning and 220, 000 deaths are reported in developing countries. About 2.2 million people, mainly belonging to developing countries are at increased risk of exposure to pesticides.

Pesticides enter the human body through ingestion, inhalation or penetration via skin. But the majority of people get affected via the intake of pesticide contaminated food. Toxic effects are produced when the concentration of pesticide in the body increases far more than its initial concentration in the environment. The effects of pesticides on human health are highly variable.

Acute Effects of Pesticides

Immediate effects of pesticide exposure include headache, stinging of the eyes and skin, irritation of the nose and throat, skin itching, appearance of the rash and blisters on the skin, dizziness, diarrhoea, abdominal pain, nausea and vomiting, blurred vision, blindness and very rarely death.

Chronic Effects of Pesticides

Chronic effects of pesticides are often lethal and may not appear even for years. Long term effects cause damage to multiple body organs and may results in following consequences:

- Pesticides have been associated with leukaemia, brain cancer, lymphoma, cancer of the breast, prostate, ovaries, and testes
- Affects reproductive capabilities, it results in stillbirth, birth defects, spontaneous abortion and infertility
- Exposure to organophosphates and carbamates causes, symptoms similar to those of increased neurotransmitter-acetylcholine.

Remedies

Pesticides are widely used chemical substances throughout the world in agriculture and public health and may cause undesired effects on human health and to environment. Pesticide



residue in food and feed crops, meat and poultry, fish and aquaculture as well as milk products generally arise from their indiscriminate use in agriculture and public health. Some of the other alternatives include:

- Regulating pesticide use
- Use of biotechnology (Developing GM crops based on transgenic technology)
- Use of bio-pesticides

Rational use of pesticides

Rational use of pesticides (RUP) can be defined as a focused sub-set of integrated crop management and integrated pest management, which attempts to mitigate the adverse effects of pesticide use by improvements in the selectivity of the products. The potential benefits include: reduction of costs, improved safety and reduced environmental impact.

Integrated pest management

The integrated pest management (IPM) approach, being promoted since 1985, is an eco-friendly strategy of pest containment by exploiting the role of natural agents/forces in harmony with other pest management tactics and with the sole aim to effect minimum disturbance to environment.

Continuous monitoring of pesticide residues in agricultural commodities

Emphasis should be given to establish additional facilities for pesticide residue testing in agricultural commodities being imported or exported and also for the regular monitoring in all agricultural commodities marketed within the country.

Farmers awareness

The dangers of acute pesticide poisoning are well known to Indian farmers, but the need is to highlight the chronic exposure which can cause many neurological diseases. The current need is to address the awareness for long term moderate exposure. The farmers need to be educated by the crop protection industry since they are the main end-users of the products

Conclusion

Pesticides have proved to be a boon for the farmers as well as people all around the world by increasing agricultural yield and by providing innumerable benefits to society indirectly. But the issue of hazards posed by pesticides to human health and the environment has raised concerns about the safety of pesticides. Exposure to pesticides and hence the harmful consequences and undesirable effects of this exposure can be minimized by several means such as alternative cropping methods or by using well-maintained spraying equipment.



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